# Mites (Acarina) associated with *Popilius disjunctus* (Illiger) (Coleoptera: Passalidae) in Eastern United States[1]

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**Abstract:** Sixteen species of mites are reported associated with *Popilius disjunctus* (Illiger) (Coleoptera: Passalidae) in eastern United States. Two new species are described: *Macrocheles* **disjunctus** and *M.* **whartoni**. Changes in nomenclature are as follows: *Cosmolaelaps passali* Hunter and Mollin = *C. trifidus* (Pearse and Wharton), new synonymy and new combination; *Dendrolaelaps passalorum* (Pearse and Wharton), new combination. Diagnostic features, as well as distributional and biological information are given for most species.

A surprisingly large and somewhat heterogenous group of mites is found in association with various species of passalid beetles (Coleoptera: Passalidae) (Pearse et al., 1936; Tragardh, 1946, 1950; Womersley, 1957; Schuster and Lavoipierre, 1970; Hunter and co-workers, 1964–1969). Either adults, immature stages, or all developmental stages of certain species are found attached to various parts of the beetle. The relationship between the mites and beetles is undoubtedly one of phoresy, *i.e.*, the mite utilizing the beetle as a means of transport from one habitat to another. The attractiveness of the beetle *Popilius disjunctus* (Illiger) to the mite has been observed by Mollin and Hunter (1964) and Hunter and Davis (1965) working with *Cosmolaelaps trifidus* (Pearse and Wharton) and *Euzercon latus* (Banks) respectively. They concluded that these mites react to an attractant present on the external surface of their beetle host. *Cosmolaelaps trifidus* reproduces only after a period of contact with the beetle. The feeding habits of the majority of these mites are unknown. But certain other species of Macrochelidae will feed on acarid mites (*Caloglyphus* spp.), fly eggs and larvae, and nematodes (Axtell, 1961, 1963, 1969). Probably many other species will also feed on the same hosts.

This study is based on material taken by M. D. Delfinado from pinned *P. disjunctus* beetles in the New York State Museum and Science Service collection through the courtesy of John Wilcox, and from beetles sent by Marcel

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Reeves, University of New Hampshire. Other mite specimens examined are from the collection of Preston E. Hunter, University of Georgia at Athens.

This paper reports the following families of mites found on *P. disjunctus* in eastern United States: Diarthrophallidae (1 sp.), Diplogyniidae (1 sp.), Euzerconidae (1 sp.), Megisthanidae (1 sp.), Digamasellidae (1 sp.), Laelapidae (2 spp.), Macrochelidae (3 spp.), and Heterocheylidae (1 sp.). Also listed here, but not discussed, are immature specimens of 3 uropodine species described by Pearse and Wharton (1936) and unnamed species of Anoetidae and Acaridae. *Cosmolaelaps passali* (Hunter and Mollin, 1964), is synonymized with *Cosmolaelaps trifidus* (Pearse and Wharton, 1936), new combination. Two new species of *Macrocheles* are described.

Family Diarthrophallidae

*Diarthrophallus quercus* (Pearse and Wharton)

*Uroseius quercus* Pearse and Wharton 1936: 478.

*Diarthrophallus quercus*, Tragardh, 1946: 371 (taxonomy); Hunter and Glover, 1968: 193 (re-description).

*Passalobia duodecimpilosa* Lombardini, 1938: 46. Synonymy by Hunter and Glover (1968).

*Diarthrophallus similis* Tragardh, 1946: 380. Synonymy by Womersley (1961).

*Remarks*: This unique species, upon which the genus and family was based (Tragardh, 1946), is distinguished in all stages by having very long, barbed adanal and body setae; very short peritremes in the adult which are absent in the immature stages, by the sternal shield lacking lateral endopodal projections, and the tarsus of leg I without caruncle or claws and terminating in a series of short and long setae. All developmental stages are found on the beetle. Pearse and Wharton (1936) observed that this "mite is usually found on the outside of *Passalus*, where it lurks in the crevices between parts near the anterior end, but sometimes it creeps under the elytra." The present material was taken on the coxal regions and under the elytra.

*Distribution*. This is one of the commonest species of mites found on the venter of head and coxal regions and under the elytra of *P. disjunctus*. It is widely distributed in the eastern United States and has also been recorded from Brazil on an unknown passalid beetle and from Mexico on *Proculus goryi* Melly.

Family Digamasellidae

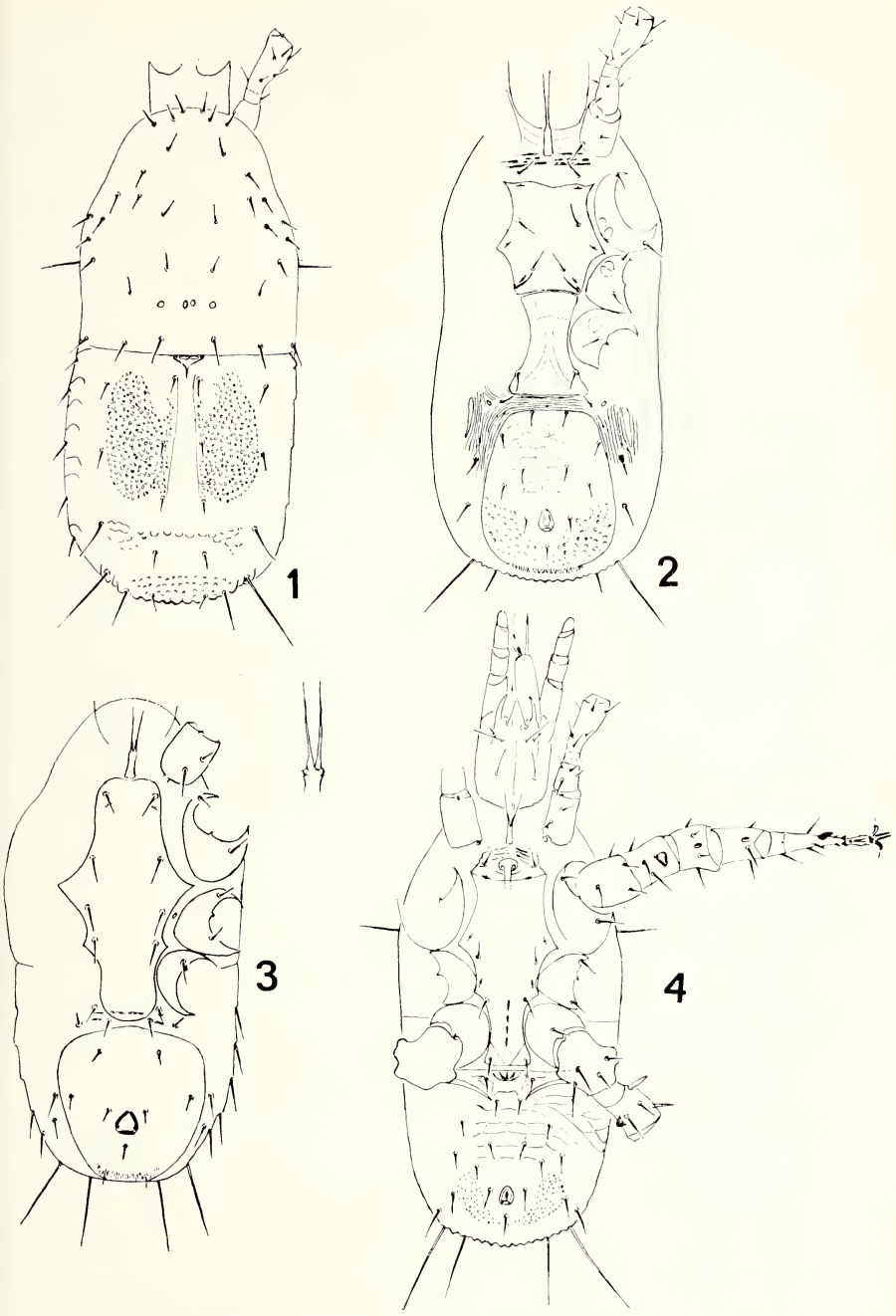
*Dendrolaelaps passalorum* (Pearse and Wharton). New combination.

(Figures 1–4)

*Zercon passalorum* Pearse and Wharton, 1936: 477.

*Remarks*. The type specimens of this species are presumably lost. Figures 28–30 (Pearse and Wharton 1936: 477) on *D. passalorum* are undoubtedly based on nymphs. We have adults of both sexes and nymphs taken from the beetle habitat and under the elytra of *P. disjunctus*. A brief description of the adults is as follows:

*Female*. All dorsal and body setae simple; posterior end of dorsal plate sculptured, punctate with scalloped margin; dorsal plate notched medially as shown on figure 1, with 2 small platelets above the slit; infundibulum foraminis extending entire length of




FIGS. 1–4. *Dendrolaelaps passalorum* (Pearse and Wharton). 1, dorsum of female; 2, venter of female; 3, venter of nymph with tritosternum; 4, venter of male.

trochanter and femur of Leg III; ventri-anal plate with 4 pairs of setae in addition to anal setae. *Male.* Spermatodactyl straight, shorter than fixed chela; genital opening located at anterior margin of sternal plate; femur, genu and tibia of leg II with ventral protuberances; trochanter and femur of leg IV with small, lateral protuberances as in figure 4; posterior end of dorsal plate as in female. Dorsal seta $S_4$ as long as seta $Z_5$ but stronger; $S_5$ longest and most conspicuous of dorsal setae.

*Distribution.* Previously known only from North Carolina (type locality). We have examined a series of immatures taken under the elytra of *Popilius* from New York (Lintner, coll.), Ohio (P. Lowry, coll.), Iowa (L. C. Glover, coll.) and Virginia (E. W. Baker, coll.); adult males and females were collected from *Popilius* habitat under a log pile in Virginia.

## Family Diplogyniidae

### *Passalacarus sylvestris* Pearse and Wharton

*Passalacarus sylvestris* Pearse and Wharton: 475; Tragardh, 1950: 369 (re-description, taxonomy).

*Remarks. P. sylvestris* was re-described and figured in detail by Tragardh (1950) who placed it in the family Diplogyniidae. This species is distinguished in both sexes by having the anal plate fused with the ventral plate; the female has a pair of sternal setae placed close together at the middle near the posterior margin of the sternal plate, and a pair of triangular plates hinged laterally to the ventral plate bearing 2 pairs of long setae near the lateral margin. The male genital aperture is situated in front of the anterior margin of the sternal plate. The biology is not known.

*Distribution. P. sylvestris* was previously known from North Carolina (type locality). We have examined specimens taken in the anterior and hind coxal regions of *P. disjunctus* from Iowa (L. C. Glover, coll.), New York (Moore, coll.) and from Virginia collected in an alcohol jar with the beetles (E. W. Baker, coll.).

## Family Euzerconidae

### *Euzercon latus* (Banks)

*Celaenopsis latus* Banks, 1909: 135.

*Euzercon latus*, Hunter and Davis, 1965: 30 (biology).

*Remarks.* This euzerconid mite is characterized by having the lateral plates of the female fused with the ventral plate, by having a T-shaped genital opening and by having the anal plate separated from the ventral plate. No male or immature stage has been examined by us. Biology and descriptions of both sexes, including the immature stages are given by Hunter and Davis (1965).

*Distribution. E. latus* was originally found on a passalid beetle at Guelph, Ontario, Canada; it has been recorded since from North Carolina and Georgia. We have examined females taken on the anterior coxae of *P. disjunctus* from New York (Moore, coll.) and Iowa (L. C. Glover, coll.).

## Family Laelapidae

### *Cosmolaelaps trifidus* (Pearse and Wharton). New combination.

*Seiodes trifidus* Pearse and Wharton, 1936: 474.

*Cosmolaelaps passali* Hunter and Mollin, 1964: 247. New synonymy.

*Remarks.* We have remounted and examined the type specimens of *Seiodes trifidus*; it is now obvious that this species is a typical laelapid mite. Both sexes can be distinguished by the strong, lanceolate setae on the dorsal plate and by the short, strong ventral setae on the posterior region of the body. Mollin and Hunter (1964) and Hunter and Mollin (1964) gave detailed biology, descriptions and illustrations of this species as *Cosmolaelaps passali*, a synonym of *Seiodes trifidus*. We cannot find characters to separate them.

*Distribution.* Hunter and Mollin (1964) reported that the adults were usually found ventrally between the leg and prothoracic regions, or attached to the setae in front of legs I of *Popilius* from Georgia. One male was removed from the head region of *P. disjunctus* from Louisiana (L. C. Glover, coll.). Previously known only from North Carolina (type locality).

*Hypoaspis* (*Geolaelaps*) *disjuncta* Hunter and Yeh

*Hypoaspis* (*Geolaelaps*) *disjuncta* Hunter and Yeh, 1969: 97.

*Remarks. H. disjuncta* is a weakly sclerotized laelapid mite with simple body setae. It may be distinguished readily by the shape of the sternal plate which has a rounded posterior margin extending posteriorly to the region of coxae IV, and in that the dorsal plate possesses 32 pairs of simple setae and completely covers the dorsum. The biology of this mite was observed by Hunter and Yeh (1969).

*Distribution.* This species was found attached to the hairs on the venter of the prothorax of *Popilius* from Georgia; it was also found in decayed frass mixed with soil in the beetle tunnels. We have females taken on the coxal region and mouthparts of *P. disjunctus* from Ohio (P. Lowry, coll.) and Iowa (L. C. Glover, coll.).

Family Macrochelidae

*Macrocheles tridentatus* Pearse and Wharton

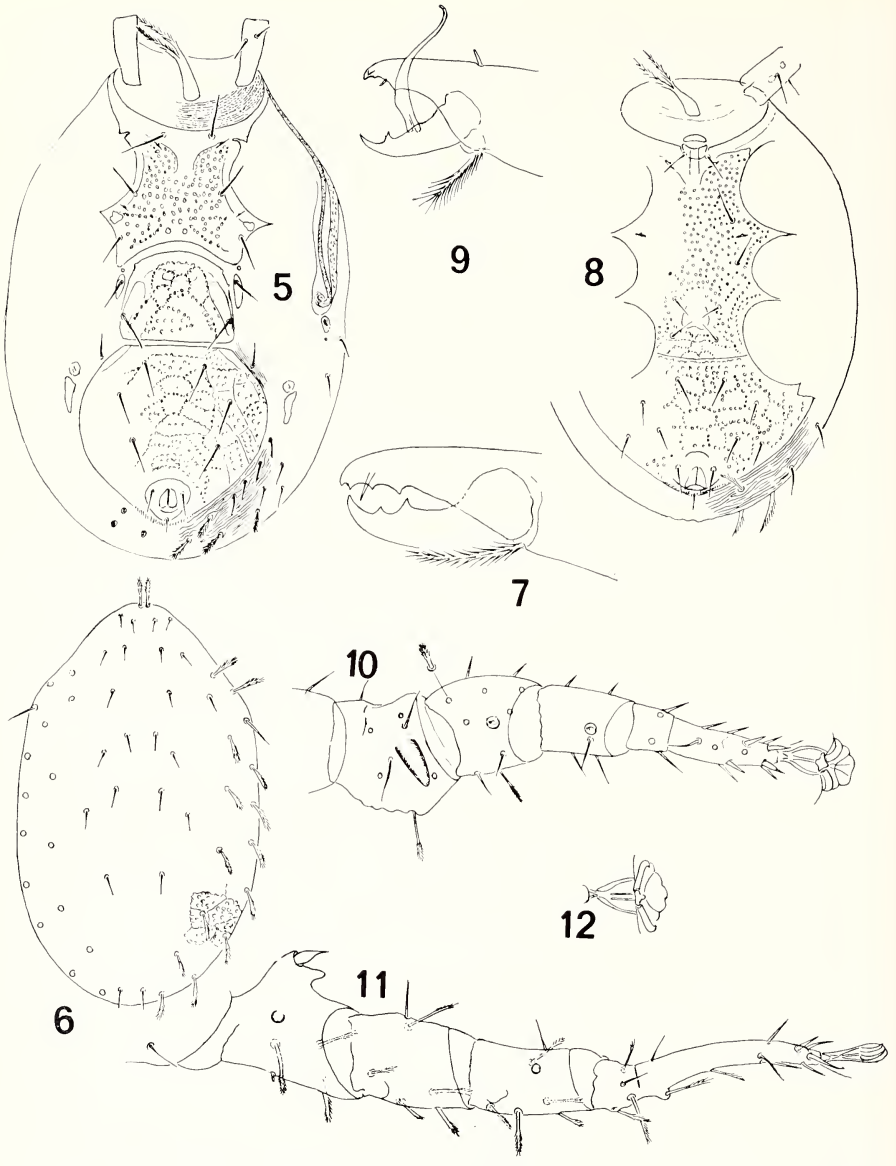
(Figures 5–11)

*Macrocheles tridentatus* Pearse and Wharton, 1936: 473.

*Remarks.* We have remounted and examined the type material (USNM Type No. 1172, male and female) of *M. tridentatus*. The type specimen labelled male proved to be a female as shown in figure 15 (Pearse and Wharton, 1936: 473). This mite represents a new species of macrochelid. Figure 17 (Pearse and Wharton, loc. cit.) represents the type female of *M. tridentatus*. Brief descriptions of the adults of *M. tridentatus* are as follows:

*Female.* Dorsal plate finely punctate and with reticulate pattern of punctate lines diminishing at midregion. Vertical setae $D_1$ and all marginal (except $M_2$) and lateral setae pectinate; seta $D_5$ and all other medial and dorsal setae simple, slender and lanceolate. Sternal plate punctate with ridges of polygonal design. Genital and ventri-anal plates with reticulate patterns of punctate lines. All setae on these plates simple. Fixed and movable chelae of chelicerae with 4 and 2 teeth respectively; arthrodial brush reaching to ½ length of movable chela. Leg I with tibia shorter than tarsus. Genu of leg IV with 6 setae pectinate apically; all other leg setae simple.

*Male.* Dorsal plate ornamentations similar to those of female. Holoventral plate densely punctate and with faint polygonal pattern, ventri-anal plate punctate, with reticulate pattern of punctate lines. All setae on these plates simple. Fixed chelae with 4 teeth, movable chelae with 1 tooth, spermatodactyl about the length of movable chela. Femur, genu and tibia of leg II each with a spur, largest on femur. Femur of leg IV as figured.




FIGS. 5–12. *Macrocheles tridentatus* Pearse and Wharton. 5, venter of female; 6, dorsum of female; 7, chelicera of female; 8, venter of male; 9, chelicera of male; 10, leg II of male; 11, leg IV of male; 12, ambulacra of leg III of male.

*Distribution. M. tridentatus* was previously known only from North Carolina (type locality). We have examined females taken on the coxal region of *P. disjunctus* from Ohio (P. Lowry, coll.) and Georgia (Y. T. Chiu, coll.) and males collected in beetle frass from Georgia.

*Macrocheles* **disjunctus**, n. sp.

(Figures 12–15)

*Female.* Length of body 735 microns. Dorsal plate heavily ornamented with circular and polygonal pits of varying sizes; all dorsal setae clublike and strongly plumose, with most marginal, lateral and anterior dorsal setae stoutest and longest; extra marginal (integumental) setae also plumose; integument outside plate rugose, granular. Sternal plate pitted, all setae pectinate. Genital plate small, rounded posteriorly, with pitted reticulate pattern; setae pectinate. Ventri-anal plate small, longer than wide, pitted; all setae on this plate pectinate; 3 anal setae simple; integument between these plates rugose; 2 pairs of sclerotized platelets located between genital and ventri-anal plates. Metasternal plates very small, each with a pectinate seta. Metapodals not seen. Chelicerae with movable chelae unidentate, fixed chelae tridentate; arthrodial brush reaching to ½ length of movable chela. Legs rugose; most setae strong, either plumose or pectinate. Tarsus of leg I longer than tibia.

*Male.* Not known.

*Holotype.* Female, Duncan Falls, Ohio, June 18, 1916 (P. Lowry, coll.), taken on venter of *P. disjunctus*, deposited in the New York State Museum and Science Service at Albany.

*Paratypes.* 1 female with same data as holotype; 1 female, Ft. McPherson, Georgia, July 22, 1946 (no coll.); 1 female, McRae, Georgia, November 7, 1959 (H. O. Lund, coll.), both taken on passalid beetle, deposited in the U.S. National Museum and New York State Museum and Science Service collections.

*Remarks.* The pitted ornamentation of the dorsal plate and the plumose setae, the rugose legs and the small genital and ventri-anal plates are distinctive for this species.

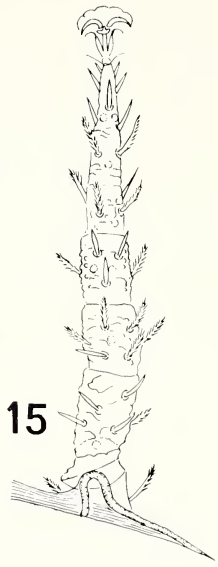
*Macrocheles* **whartoni**, n. sp.

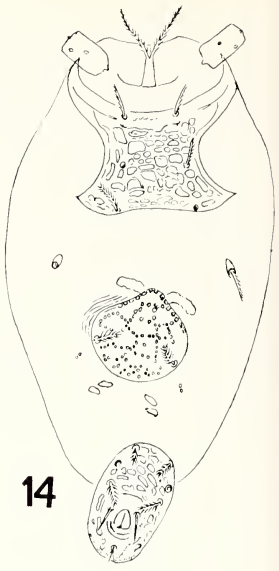
(Figures 16–18)

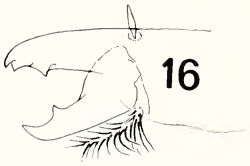
*Female.* Length of body 370 microns. Dorsal plate finely punctate and weakly ornamented with a network of fine punctate lines. Vertical setae $D_1$ short, spinelike, simple and close to each other; setae $D_5$ finely pectinate; remainder of setae on dorsal plate simple, long, thin, and lanceolate; extra marginal setae on integument simple. Sternal plate with characteristic granular and knobby ornamentation; all sternal setae simple. Genital plate truncate posteriorly, and nearly touching anterior margin of ventri-anal plate, with concentric pattern of small granular lines. Ventri-anal plate truncate anteriorly, with punctate polygonal and concentric ornamentation, all setae on this plate simple. Metasternal setae simple, located on small elongate plates. Metapodal plates very small, elongate and weakly sclerotized. Chelicerae with bidentate fixed chelae and unidentate movable chelae; arthrodial brush reaching to ½ length of movable chela. Leg I with tibia shorter than tarsus. All leg setae simple.

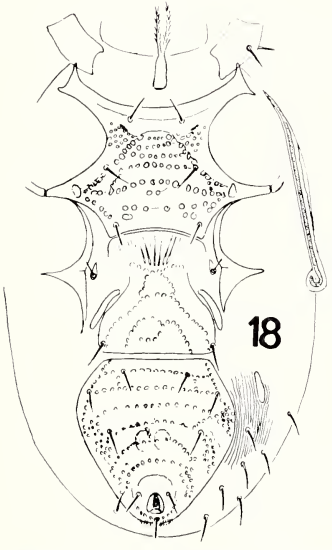
*Male.* Not known.

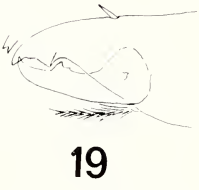
*Holotype.* Female, Athens, Georgia, August 10, 1965 (Y. T. Chiu, coll.), on passalid beetle, deposited in the New York State Museum and Science Service at Albany. *Paratypes.* 6 females with same data as holotype; 1 female, Clarke Co., Georgia, October 4, 1960, inside rotten log, and 1 female, Athens, Georgia, University Farm, January 12, 1961, in tunnel of passalid beetle, both collected by P. E. Hunter; 1 female, Duke Forest, Durham, North Carolina, June 12, 1933, "on *Passalus cornutus* Fabr." (A. S. Pearse, coll., labelled USNM type no. 1172); 3 females, Stafford, Virginia, August 23, 1973, in *Popilius* habitat under oak log, and 2 females on *Popilius* same locality, all collected by E. W. Baker, deposited in the U.S. National Museum and New York State Museum and Science Service collections.

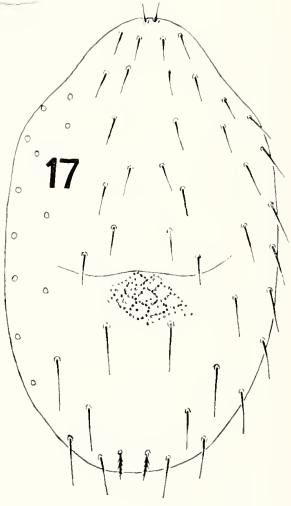




FIGS. 13–16. *Macrocheles disjunctus*, n. sp. 13, dorsum of female; 14, venter of female; 15, leg III of female; 16, chelicera of female.

FIGS. 17–19. *Macrocheles whartoni*, n. sp. 17, dorsum of female; 18, venter of female; 19, chelicera of female.

*Remarks. M.* **whartoni** is distinguished by having only the $D_s$ setae pectinate, the remainder of body setae being simple, and by the characteristic knobby and granular ornamentation of the sternal plate. It is the common macrochelid species found on *P. disjunctus*.

This mite is named for G. W. Wharton of the Ohio State University.

Family Megisthanidae

*Megisthanus floridanus* Banks

*Megisthanus floridanus* Banks, 1904: 145; Baker and Wharton, 1952: 45; Krantz, 1971: 130.

*Remarks.* Pearse and Wharton (1936) reported that this mite has never been taken in abundance and none has actually been taken on the beetles which were examined each month. Our present collection contains 2 females and 1 male collected in *P. disjunctus* habitat under a log pile in Virginia. None was found on the beetle. Baker and Wharton (1952), and recently Krantz (1971), figured *M. floridanus*. It is distinguished by its unique genital opening: crescent shaped in the female and placed just below the sternal plate, whereas the male genital opening is located in the sternal plate aperture.

*Distribution.* Florida, Georgia and North Carolina. It was collected in Virginia in the beetle habitat by E. W. Baker.

Family Uropodidae

In the collection are immatures of 3 species of uropodine mites which were named by Pearse and Wharton (1936). Adults are not known.

*Uroobovella spinosa* Pearse and Wharton, 1936: 480. Genus uncertain.

*Distribution.* North Carolina, Ohio, New York, Iowa and Georgia. These mites were found on the front and hind coxal region of the beetles and under the elytra.

*Uroobovella setosa* Pearse and Wharton, 1936: 479. Genus uncertain.

*Distribution.* North Carolina, Louisiana, Ohio, New York and Georgia. The specimens were taken on the front coxal region of *Popilius*.

*Uroobovella levis* Pearse and Wharton, 1936: 481. Genus uncertain.

*Distribution.* This species is the most common of the uropodine mites found on the beetle in North Carolina, New York, Ohio, Iowa, Virginia, Georgia and Connecticut. It is found attached to the hollow areas beneath the head of *Popilius* and on the front coxal region.

Family Heterocheylidae

*Heterocheylus proximus* Schuster and Lavoipierre

*Heterocheylus proximus* Schuster and Lavoipierre, 1970: 26.

*Heterocheylus fusiformis* Lombardini, of Pearse and Wharton, 1936: 747. Misidentification.

*Remarks. H. proximus* is obviously the heterocheylid mite reported by Pearse and Wharton (1936) from North Carolina. It is distinguished from other North and South American species in that tarsus IV has 4 setae; the dorsal seta of tarsus IV is located on the distal portion of the segment which lacks the small basal posterior seta. Seta $I_m$ is anterior to seta IM (after Schuster and Lavoipierre, 1970: 22).

The biology is not known.

*Distribution. H. proximus* is found under the elytra of *P. disjunctus*, and is common and widely distributed in the eastern United States. It has also been recorded on a number of passalid species from Mexico, Central and South America.

Family Anoetidae

*Histiostoma* sp.

*Remarks.* The figure of the hypopus by Pearse and Wharton (1936) readily places this mite in the above family. They gave it no generic name and placed it in the family 'Tyroglyphidae.' The mites collected on the beetles are *Histiostoma* sp., and probably represent an undescribed species.

*Distribution.* North Carolina, Connecticut and Iowa. The mites were found on the coxal region and under the elytra of the *P. disjunctus*.

Family Acaridae

Genus nr. *Forcellinia.*

*Remarks.* Only the hypopial forms were found, and they are probably an undescribed genus. Pearse and Wharton (1936) gave a rough figure of this form.

*Distribution.* North Carolina, New York, Iowa, Connecticut, Virginia and Louisiana. They were found on the front and hind legs, coxal region and under the elytra of *Popilius*.

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